REMARKS

Applicant has amended claims 1, 2, 5-6, 11, 16, 21, 22, and 26 and added new claim 33. Accordingly, claims 1-33 are pending for examination with claims 1, 11, 21, and 31 being independent claims.

Objections to the Abstract

The Abstract was objected to because it exceeded 150 words in length. Applicant has replaced the Abstract to address the objection, as indicated in the attached replacement Abstract.

Objections to the Specification

The Specification was objected to due to some typographical errors in reference numerals. Applicant has corrected those errors with the amendments to the Specification requested above.

Rejections under 35 U.S.C. § 102

Claims 1-4, 6-7, 10-14, 16-17, 20-24, 26-27, and 30-31 stand rejected under 35 U.S.C. § 102 as being anticipated by Papaefstathiou et al., "An Introduction to the Layered Characterisation of High Performance Systems", Research Report CS-RR-335, The University of Warwick, December 5, 1997 [hereinafter Warwick]. Applicant respectfully traverses the rejection as follows.

Warwick generally discloses a system for evaluating the performance of a single application in a parallel processing computer system. The application to be evaluated may be characterized through a characterization methodology implemented by a user, and the evaluation process is hidden from the user. (*See*, Warwick, §1, Introduction,

para. 2, pages 1-2). Specifically, the characterization methodology takes a layered approach to characterize the workload of the application in a software implementation. The layers characterizing the workload include the application layer which describes the application in terms of a sequence of sub-tasks, an application sub-task layer which describes the sequential part of every subtask within an application that can be executed in parallel, a parallel template layer which describes how to parallelize the computations of the application sub-tasks, and a hardware layer which characterizes the communication and computation abilities of the system. (*See*, Warwick, § 1, Introduction, para. 4, bullets 1-4, page 2). Accordingly, the diagram of Figure 1 of page 3 of Warwick illustrates the layers of the characterization framework of the application (e.g., workload). These layers are used to compile software-based PACE objects including both the subtask objects described with reference to Figure 5 (*see*, Warwick, page 5) and the parallel template objects described with reference to Figure 6 (*see*, Warwick, page 6). The compiled PACE objects may be evaluated by an evaluation engine, and the results combined to produce detailed predictions of the performance of the whole application. (*See*, Warwick, §3.2, The Evaluation Engine, para. 1, page 9). More particularly, Figures 5 and 6 describe how to implement the compiled PACE objects (characterizing application and the workload) into hardware and evaluate the application. Accordingly, the evaluation engine disclosed within Warwick is specifically directed towards implementing a PACE object-based workload model in software, e.g., by defining a workload with the above-described layers and PACE objects.

In contrast, the present application focuses on a performance evaluation architecture which renders the model and builds a system that runs the model, e.g., how to build the evaluation engine in a software architecture. The disclosed performance technology infrastructure is directed towards how to implement an evaluation engine (similar to the evaluation engine of Warwick above), but in a flexible manner such that

various computer networks under various workload conditions may be analyzed. (*See*, Specification, page 4, lines 4-6). The evaluation engine disclosed may be used to evaluate any application, not just parallel applications. Thus, the disclosed evaluation engine may be used to support parallel workloads (i.e., a single application that uses many computers to solve a common task), distributed workloads (i.e., loosely coupled application running on multiple computers and contributing to the same service), and multiple separate applications sharing a computer infrastructure. With reference to FIG. 2, the technology infrastructure includes, generally, a workload specification component 200 (e.g., the software characterizing the application), hardware model component 204, system and model configuration component 220, and evaluation engine component 202. (*See*, Specification, p. 6, lines 12-14 and p. 12, lines 15-19). The workload specification component provides one or more resource usage requests, such as events 212. For example, an example resource usage request may indicate "compute 100 cycles on a Pentium 4 processor", which may be passed to the evaluation engine. The evaluation engine, through reference to the system and model configuration component (e.g., HMC DB 220), may determine that the referenced Pentium 4 runs a Xeon 3 GHz. The evaluation engine may send the event (e.g., compute 100 cycles) and the hardware configuration 220 (e.g., a Xeon 3 GHz) to the appropriate hardware model (e.g., a CPU model), which may return the evaluation of the event, such as the amount of time to perform the event defined in the resource usage request, e.g. (to compute 100 cycles on a Pentium 4 which may be 300 ms).

Claim 1

Claim 1, as amended, recites, *inter alia,* a method for executing a computer system performance analysis model. The cited sections of Warwick describe how to define in software a workload model by separating the workload specification into layers. This definition of a workload model in Warwick does not teach or suggest how to

execute the defined model. Accordingly, the cited sections of Warwick do not teach or suggest the features of claim 1.

Claim 1, as amended, also recites, *inter alia*, second providing at least one hardware model, independently defined with regard to the workload specification, comprising hardware performance information associated with a resource. The cited section of Warwick (hardware layer, page 2, para. 7, bullet 4) describes the hardware layer of the workload specification as "a hardware layer, which is responsible for characterising the communication and computation abilities of the system." In contrast, a hardware model, as claimed in claim 1, may implement a hardware layer, but is not equivalent to a hardware layer which is used in the workload characterization. Thus, the cited section of Warwick does not teach or suggest the features of claim 1.

Claim 1, as amended, also recites, *inter alia*, third providing a hardware configuration which defines the resource and including a reference to the resource defined by the hardware model. The cited section of Warwick (parallelization template, page 2, paragraph 7) describes how to run a single application among multiple processors by stating "a parallel template layer, that describes the computation-communication pattern and other hardware resource usage." Moreover, Warwick further describes the parallel template object of the parallel template layer as having a syntax "similar to the application and subtask objects with the exception of the statement link and the existence of additional statement for exec procedures." (Warwick, § 2.3, Parallel Template Objects, page 8, 1st para.). Specifically, the parallel template object provides the same information as the application and subtask objects, but in a manner necessary for parallel processing. Thus, neither the parallel template object nor the parallel template layer of Warwick describe a hardware configuration which defines resources as recited in claim 1. Rather, the parallel template of Warwick defines tasks of the characterized application in a manner specific to parallel processing. There is no

definition of the resources of a hardware configuration. Thus, Warwick does not teach or suggest the features of claim 1.

Accordingly, claim 1 distinguishes over the cited sections of Warwick, and Applicant respectfully requests that the rejection under § 102 be withdrawn. Dependent claims 2-10 and 32-33 depend from independent claim 1, and are patentable for at least the foregoing reasons.

Independent Claim 11

Claim 11, as amended, recites, *inter alia*, a workload specification interface including a workload request output and a hardware system configuration output; and a hardware model interface including a resource request input based on at least a portion of a workload request, a hardware performance parameter input, and a performance data output. Warwick does not teach or suggest these features of claim 11. Specifically, the cited sections of Warwick (object interfacing, page 5, Figure 3) describe how to define the workload in software, which is analogous to the Performance Specification Language of FIG. 1 of the present Specification. There is no reference in the cited sections of Warwick indicating a workload specification interface and a hardware model interface which may be used by the evaluation engine to define how to evaluate the workload. Although page 8 of Warwick describes a tool to implement the workload specification defined by the PACE objects, this tool of Warwick cannot be modified since it does not include the interfaces claimed in claim 11. Thus, claim 11 distinguishes over the cited sections of Warwick, and Applicant respectfully requests withdrawal of the ejection under § 102.

Claim 11, as amended, also recites, *inter alia*, a component configuration database associating the hardware system configuration with a hardware performance

parameter. Warwick does not teach or suggest these features of claim 11. Specifically, the cited section of Warwick (parallisation template, page 2, paragraph 7) describes how to run a single application among multiple processors by stating "a parallel template layer, that describes the computation-communication pattern and other hardware resource usage." As noted above with reference to claim 1, neither the parallel template layer nor the parallel template object of Warwick describe a hardware configuration which associates the hardware system configuration with a hardware performance parameter as recited in claim 11. Rather, the parallel template of Warwick defines tasks of the characterized application in a manner specific to parallel processing. There is no association of the hardware configuration with any performance parameter. Thus, Warwick does not teach or suggest the features of claim 11.

Claim 11, as amended, also recites, *inter alia*, an evaluation engine comprising an augmentable program structure including a set of slots for receiving a workload specification including the workload request input via the workload specification interface, and a hardware performance parameter from the component configuration database, wherein the performance data corresponding to devices specifiable within the hardware system configuration is retrieved from at least one hardware model via the hardware model interface. As noted above, page 8 of Warwick describes a tool to implement the workload specification defined by the PACE objects; however, this tool of Warwick cannot be modified since it does not include the interfaces claimed in claim 11. Thus, claim 11 distinguishes over the cited sections of Warwick, and Applicant respectfully requests withdrawal of the ejection under § 102.

Accordingly, claim 11 distinguishes over the cited sections of Warwick, and Applicant respectfully requests that the rejection under § 102 be withdrawn. Dependent

claims 12-20 depend from independent claim 11, and are patentable for at least the foregoing reasons.

Independent Claim 21

Independent claim 21 is not anticipated by the cited sections of Warwick. As discussed above with respect to claim 1, the cited sections of Warwick do not teach or suggest executing a computer system performance analysis model, do not teach or suggest providing at least one hardware model independently defined with regard to the workload specification, and do not teach or suggest providing a hardware configuration which defines the resource and including a reference to the resource defined by the hardware model. Accordingly, claim 21 is patentable over the cited sections of Warwick for at least the foregoing reasons set forth with respect to claim 1. Claims 22-24, 26-27, and 30 depend from claim 21 and are also patentable over Warwick for the foregoing reasons.

Independent Claim 31

Independent claim 31 is not anticipated by the cited sections of Warwick. As discussed above with respect to claim 11, the cited sections of Warwick do not teach or suggest a workload specification interface including a workload request output, and a hardware system configuration output; a hardware model interface including a resource request input based on at least a portion of a workload request, a hardware performance parameter input, and a performance data output; a component configuration database associating the hardware system configuration with a hardware performance parameter; and a an evaluation engine comprising an augmentable program structure including a set of slots for receiving a workload specification

including the workload request input via the workload specification interface, and a hardware performance parameter from the component configuration database, wherein the performance data corresponding to devices specifiable within the hardware system configuration is retrieved from at least one hardware model via the hardware model interface. Accordingly, claim 31 is patentable over the cited sections of Warwick for at least the foregoing reasons set forth with respect to claim 11.

CONCLUSION

Accordingly, in view of the above amendment and remarks it is submitted that the claims are patentably distinct over the prior art and that all the rejections to the claims have been overcome. Reconsideration and reexamination of the above Application is requested. Based on the foregoing, Applicants respectfully requests that the pending claims be allowed, and that a timely Notice of Allowance be issued in this case. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an enclosed check please charge any deficiency to Deposit Account No. 50-0463.

Respectfully submitted,

Microsoft Corporation

Date: 8/19/05

By: _____

Carole A. Boelitz Reg. No.: 48,958
Attorney for Applicants
Direct telephone (425) 722-6035
Microsoft Corporation
One Microsoft Way
Redmond WA 98052-6399

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August 19, 2005
Date

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Rimma N. Oks

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Appendix

New Abstract

An infrastructure and a set of steps are disclosed for evaluating performance of computer systems. The infrastructure and method provide a flexible platform for carrying out analysis of various computer systems under various workload conditions. The flexible platform is achieved by allowing/supporting independent designation/incorporation of a workload specification and a system upon which the workload is executed. The analytical framework may facilitate flexible/dynamic integration of various hardware models and workload specifications into a system performance analysis, and potentially streamline development of customized computer software/system specific analyses.